WHAT IS CLAIMED IS:

1. An electrode comprising a collection of particles having an average diameter less than about 100 nm, the electrode having a root mean square surface roughness less than about five microns.

2. The electrode of claim 1 wherein the root mean square surface roughness is less than about 2.5 microns.

3. The electrode of claim 1 wherein the root mean surface roughness is less than about 1 micron.

4. The electrode of claim 1 wherein the collection of particles comprises electroactive particles.

5. The electrode of claim 4 wherein the electroactive particles comprise a composition selected from the group consisting of vanadium oxide, tin oxide, titanium oxide, silver vanadium oxide, manganese oxide, lithium manganese oxide, lithium cobalt oxide, lithium nickel oxide, lithium titanium oxide, iron sulfides, molybdenum sulfide and mixtures, composites and derivative thereof.

6. The electrode of claim 1 wherein the collection of particles comprises electrically conductive particles.

7. The electrode of claim 6 wherein the electrically conductive particles comprise graphite, exfoliated graphite, amorphous carbon or carbon fibers.

8. The electrode of claim 6 wherein the electrically conductive particles comprise elemental metal particles.

9. The electrode of claim 1 wherein effectively no electroactive particles have a diameter greater than about four times the average diameter of the collection of particles.

10. The electrode of claim 1 wherein the collection of electroactive particles have a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

11. The electrode of claim 1 further comprising a current collector comprising aluminum metal, copper metal or stainless steel metal.

12. The electrode of claim 11 wherein the current collector is a foil or an expanded mesh.

13. The electrode of claim 1 further comprising a current collector comprising graphite paper.

14. An electrode comprising electroactive particles having an average diameter less than about 100 nm and a binder comprising a polymer with an average molecular weight greater than about one million amu.

15. The electrode of claim 14 wherein the polymer has a molecular weight greater than about 5 million amu.

16. The electrode of claim 14 wherein effectively no electroactive particles have a diameter greater than about four times the average diameter of the collection of electroactive particles.

17. The electrode of claim 14 having a root mean square surface roughness less than about five microns.

18. An electrode comprising electroactive particles having an average diameter less than about 100 nm and exfoliated graphite.

19. An electrode having an average thickness less than about 10 microns, the electrode comprising particles having an average primary particle size less than about 100 nm.

20. The electrode of claim 19 having an average thickness less than about 5 microns.

21. The electrode of claim 19 having an average thickness less than about 1 micron.

22. The electrode of claim 19 wherein the collection of particles comprise electroactive particles.

23. The electrode of claim 22 wherein the electroactive particles comprise a lithium intercalation compound.

24. The electrode of claim 23 wherein the lithium intercalation compound comprises a composition selected from the group consisting of vanadium oxide, tin oxide, titanium oxide, silver vanadium oxide, manganese oxide, lithium manganese oxide, lithium titanium oxide, lithium cobalt oxide, lithium nickel oxide, iron sulfides, molybdenum sulfide and mixtures, composites and derivative thereof.

25. The electrode of claim 19 wherein the electroactive particles have an average primary particle size from about 5 nm to 50 nm.

26. The electrode of claim 19 further comprising electrically conductive particles having an average particle size less than about 100 nm.

27. The electrode of claim 19 wherein the electroactive particles include effectively no particle with an average diameter greater than about a factor of four greater than the average particle size.

28. The electrode of claim 19 wherein a surface of the electrode has a root mean square roughness of less than about five microns.

29. A battery comprising:

a positive electrode;

an negative electrode; and

a separator between the positive electrode and the negative electrode,

wherein at least one of the electrodes has an average thickness less than about 10 microns and comprises electroactive particles having an average primary particle diameter less than about 500 nm.

30. The battery of claim 29 wherein the positive electrode has an average thickness less than 10 microns and comprises electroactive particles having an average primary particle diameter less than about 500 nm.

31. The battery of claim 29 wherein the negative electrode has an average thickness less than 10 microns and comprises electroactive particles having an average primary particle diameter less than about 500 nm.

32. The battery of claim 29 wherein both the negative electrode and the positive electrode have an average thickness less than 10 microns and comprises electroactive particles having an average primary particle diameter less than about 500 nm.

33. The battery of claim 29 wherein the separator has a thickness less than about 10 microns.

34. The battery of claim 29 wherein the negative electrode comprising a lithium intercalation compound.

35. The battery of claim 29 wherein the negative electrode comprises lithium metal or a lithium alloy.

36. The battery of claim 29 wherein the negative electrode comprises tin oxide or derivatives thereof.

37. The battery of claim 29 wherein at least one of the electrodes comprises electroactive particles having an average diameter less than about 100 nm.

38. The battery of claim 29 wherein the positive electrode comprises a composition selected from the group consisting of vanadium oxide, silver vanadium oxide, manganese oxide, lithium manganese oxide, lithium titanium oxide, lithium cobalt oxide, lithium nickel

oxide, iron sulfides, molybdenum sulfide and mixtures, composites and derivative thereof.

39. The battery of claim 29 wherein the separator comprises a polymer.

40. The battery of claim 29 wherein the separator comprises a nonliquid electrolyte comprising a lithium compound between the positive electrode and the negative electrode.

41. The battery of claim 29 further comprising a current collector in electrical contact with the positive electrode, the current collector comprising aluminum metal, copper metal or stainless steel metal.

42. The battery of claim 41 wherein the current collector is a foil or an expanded mesh.

43. The battery of claim 29 further comprising a current collector in electrical contact with the negative electrode, the current collector comprising aluminum metal, copper metal or stainless steel metal.

44. The battery of claim 29 further comprising a current collector comprising graphite paper, the current collector being in electrical contact with the positive electrode or the negative electrode.

45. A battery structure comprising an electrode and a separator, wherein the electrode and separator comprise a polymer that forms a continuous matrix between the electrode and the separator, the electrode comprising electroactive particles having an average primary particle diameter less than about 100 nm.

46. The battery of claim 45 wherein the electrode is a positive electrode and the negative electrode comprises lithium metal or a lithium alloy.

47. The battery of claim 45 wherein the electrode comprises a positive electrode and the negative electrode comprises the polymer and electroactive

particles wherein the polymer forms a continuous material between the negative electrode and the separator.

48. The battery of claim 45 wherein the electrode comprises a negative electrode having electroactive particles selected from the group consisting of graphitic carbon particles and tin oxide particles.

49. A circuit comprising a monolithic structure comprising an integrated circuit and a battery wherein the current collectors of the battery are integrated with the integrated circuit, and wherein an electrode of the battery comprises electroactive particles having an average primary particle diameter less than about 100 nm.

50. A method for producing an electrode and separator structure, the method comprising establishing a steep gradient of electroactive particles within a polymer wherein the portion of the polymer with a significant concentration of electroactive particles forms the electrode and the portion of the polymer substantially devoid of electroactive particles comprises the separator.

51. The method of claim 50 wherein the electroactive particles have an average primary particle diameter less than about 100 nm.